RUGGEDCOM
INDUSTRIAL STRENGTH NETWORKS™

RuggedSwitch™

i800 Family

Installation Guide

www.ruggedcom.com

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Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

Caution

This product contains a laser system and is classified as a "CLASS 1 LASER PRODUCT".

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Should this device require service see the "Warranty" section of this installation guide.

Important

This unit should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

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1 Product Overview

1.1 Functional Overview

The RuggedSwitch™ *i*800, or *i*-Series, is a family of compact, fully managed Ethernet switches designed to operate reliably in harsh industrial environments. The flexibility of the *i*800 family allows the user to choose from managed or unmanaged, regular or extended temperature, and a mix of fiber optic or copper interfaces, and fast or Gigabit Ethernet. With up to nine Ethernet ports, the *i*800 is the perfect choice for a wide variety of demanding industrial environments such as those found in process control applications (oil and gas, petrochemical, metals and mining, wind farms).

The *i*800 can be equipped with multiple fiber optic Ethernet ports for creating a fiber optic backbone with high noise immunity and long haul connectivity. The *i*800 also provides dual 24VDC power inputs for redundancy, a removable memory card for preserving the configuration of units replaced in the field, and is packaged in a sleek, compact, die cast aluminum enclosure that can be DIN rail mounted.

Note that despite the *i*800 family's specifications, this product is not intended for mission critical power substation applications. For equipment designed for these environments, please visit http://www.ruggedcom.com or contact a Ruggedcom sales representative.

1.2 Feature Highlights

- Integrated ROS™ management (optional):
  - ROSVue web server (http and https)
  - ANSI menu system or Command Line Interface via ssh / telnet / serial console
  - Configuration via a single ASCII text file (transferable via TFTP or XMODEM)
  - SNMP v1, v2c, v3
  - RMON remote monitoring
- Advanced layer-2 switching functions:
  - Enhanced Rapid Spanning Tree (eRSTP™)
  - Quality of Service (IEEE 802.1p)
  - Link Aggregation (IEEE 802.3ad)
  - VLAN (Virtual Local Area Network – IEEE 802.1q)
  - IGMP Snooping
  - Port Mirroring
- Exceeds IEC 61000-6-2 standards for industrial environments.
- Operating temperature: -20° to 60°C (-40° to 85°C optional)
- Dual, independent low-voltage power supply inputs for redundancy: 24VDC (9-36VDC)
- Optional Form-C Failsafe output relay for critical failure or error alarming
- Full-duplex Ethernet operation (no collisions) with flow-control
- Removable microSD memory slot for configuration changes and backup, redundant firmware storage, and enhanced logging (features pending development)

1.3 *i*800 Family Front Panel View

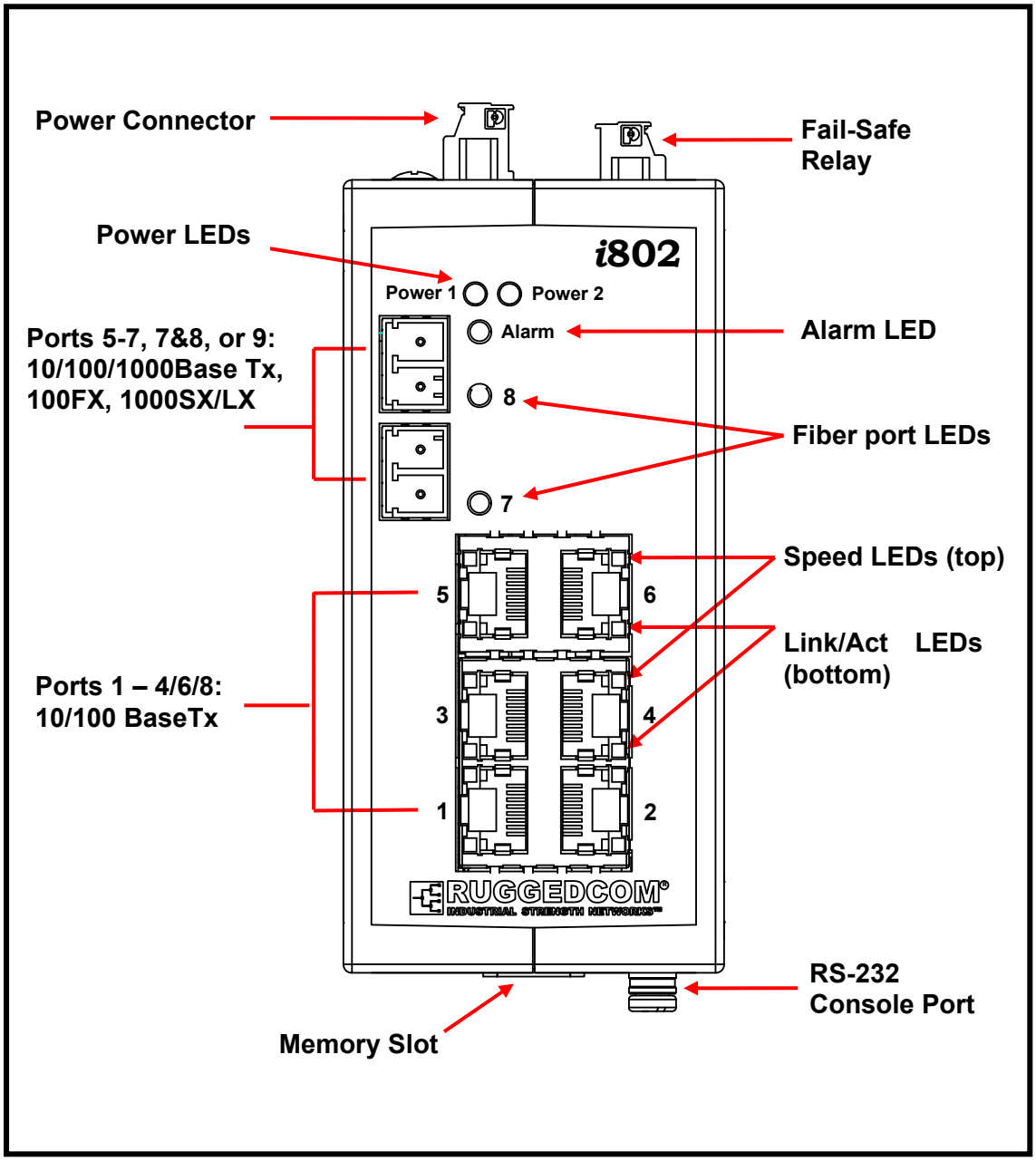

Figure 1: Front Panel

The front panel shown is representative of the *i*800 family. Note that there are several Ethernet options available in several models, outlined in Section 1.3.2, below.

1.3.1 Front Panel LEDs

ITEM	Color	Activity	Comments
Power status	Green	Solid	Power On
Alarm status	Red	Solid	Alarm condition exists
Fiber port status	Yellow	Blinking	Link Established
		Solid	Tx/Rx Activity
RJ45 Speed	Yellow	Solid	100Mbps
RJ45 Link/Act	Yellow	Solid	Link Established
		Blinking	Tx/Rx Activity

Table 1: Status LEDs

Note that the LEDs on all RJ45 Ethernet ports regardless of port orientation are connected such that the top LED of each port is always the Speed indicator and the bottom LED is always the Link/Activity indicator.

1.3.2 Front Panel Ethernet Options

A varied mix of Ethernet port options is available across four basic models. The basic configuration and available options for each model are listed in Table 2, below.

<table>
<tr><th>Port</th><th>i800</th><th>i801</th><th>i802</th><th>i803</th></tr>
<tr><td>1 to 4</td><td>10/100Tx</td><td>10/100Tx</td><td>10/100Tx</td><td>10/100Tx</td></tr>
<tr><td>5</td><td rowspan="4">10/100Tx</td><td rowspan="4">10/100Tx</td><td rowspan="2">10/100Tx</td><td>100FX MM/SM</td></tr>
<tr><td>6</td><td rowspan="2">100FX MM/SM
1000SX MM
1000LX SM</td></tr>
<tr><td>7</td><td rowspan="2">10/100/1000Tx
100FX MM/SM
1000SX MM
1000LX SM</td></tr>
<tr><td>8</td><td>Not present</td></tr>
<tr><td>9</td><td>Not present</td><td>10/100/1000Tx
1000SX MM
1000LX SM</td><td>Not present</td><td>Not present</td></tr>
</table>

Table 2: Front Panel Ethernet Options by model

For detailed Ethernet port specifications, please refer to Sections 3.5 and 3.6.

1.4 *i*800 Family Top Panel View

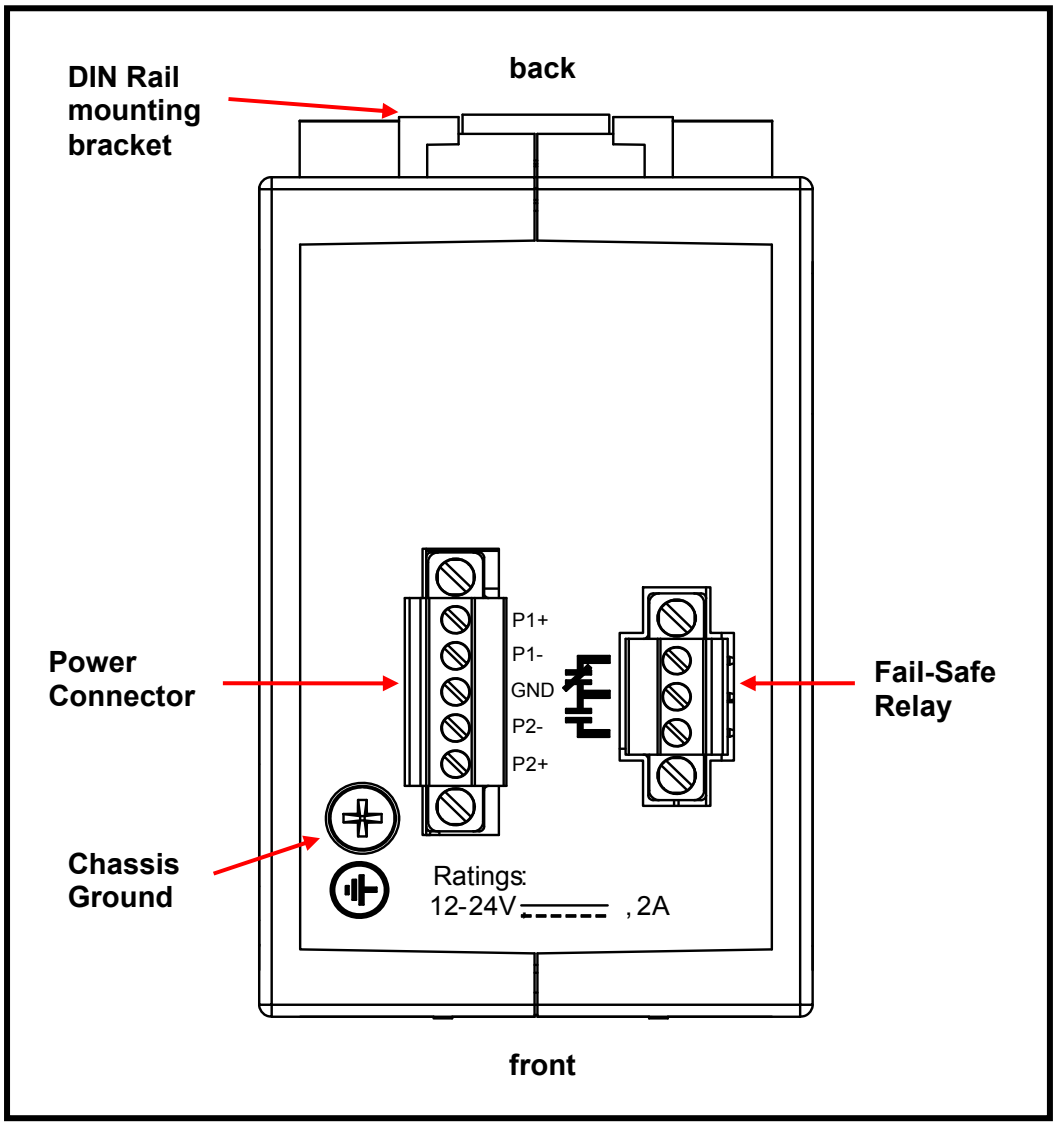

Figure 2: Top Panel

For details on connecting the power supplies and Ground, see Section 2.2.

For details on connecting the Fail-Safe Relay, see Section 2.3

1.5 *i*800 Family Bottom Panel View

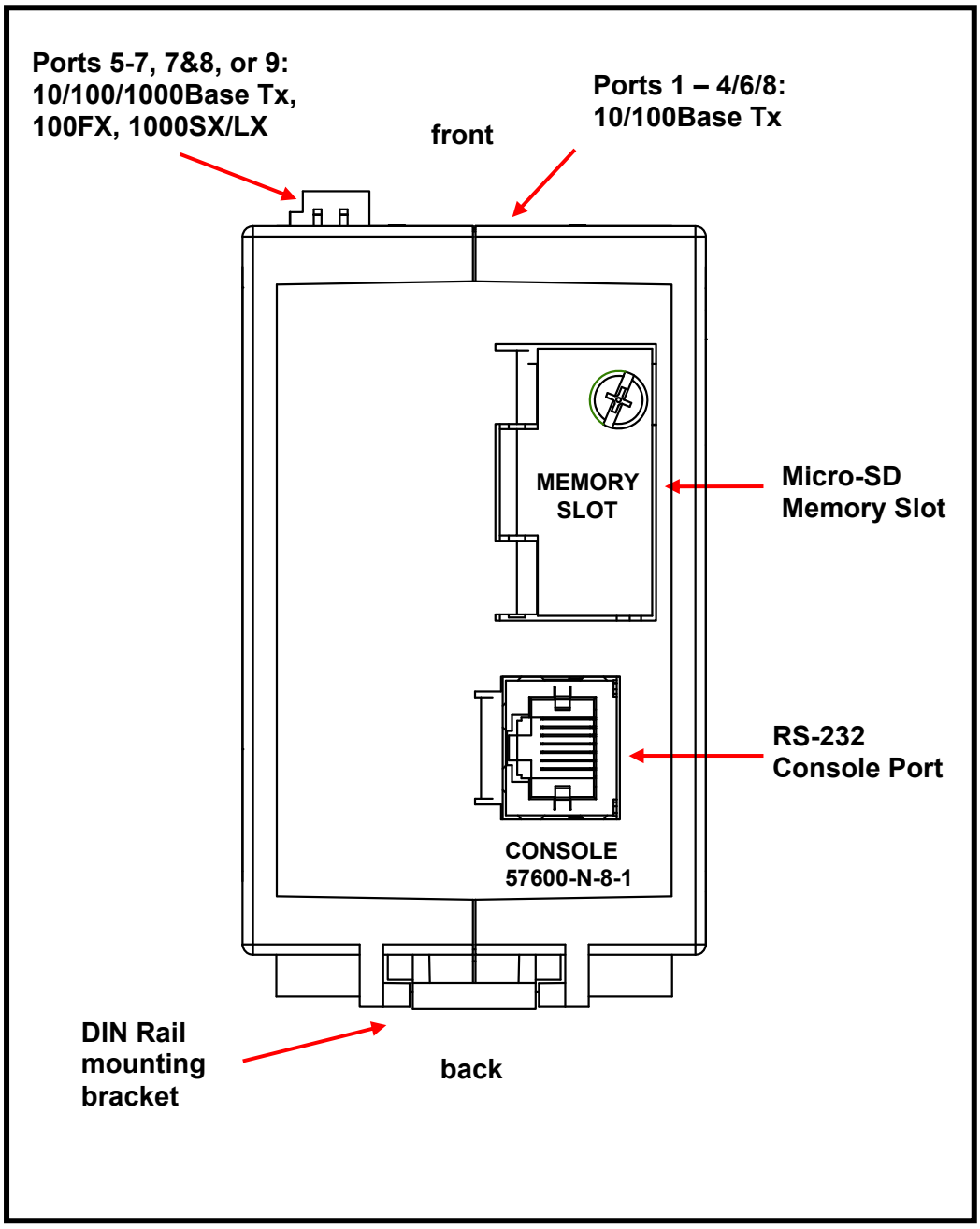

Figure 3: Bottom Panel

For details on connecting the console port, see Section 2.4.

For a description of the memory slot, see Section 2.6.

2 Installation

2.1 DIN Rail Mounting

The *i*800 family of switches comes with a standard DIN rail mounting bracket. Figure 4 details the mounting configuration for a standard 1" DIN Rail.

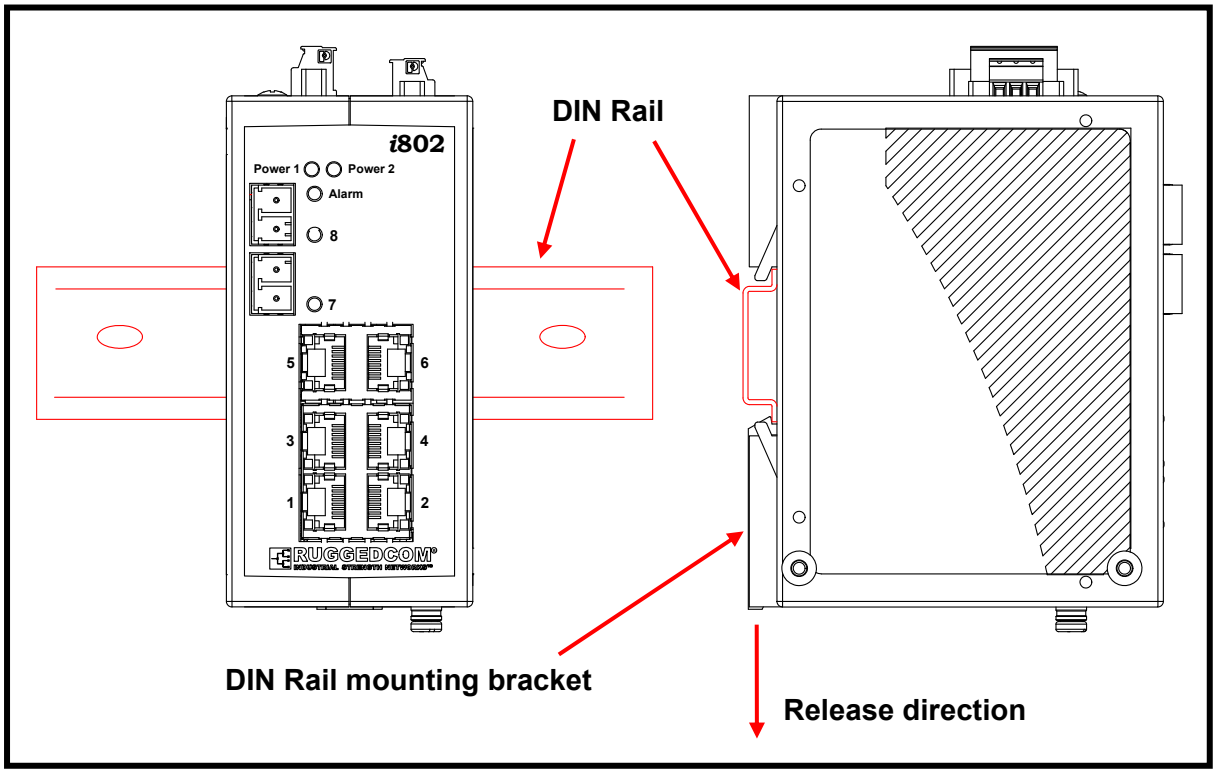

Figure 4: DIN Rail Mounting

2.2 Power Supply Wiring and Grounding

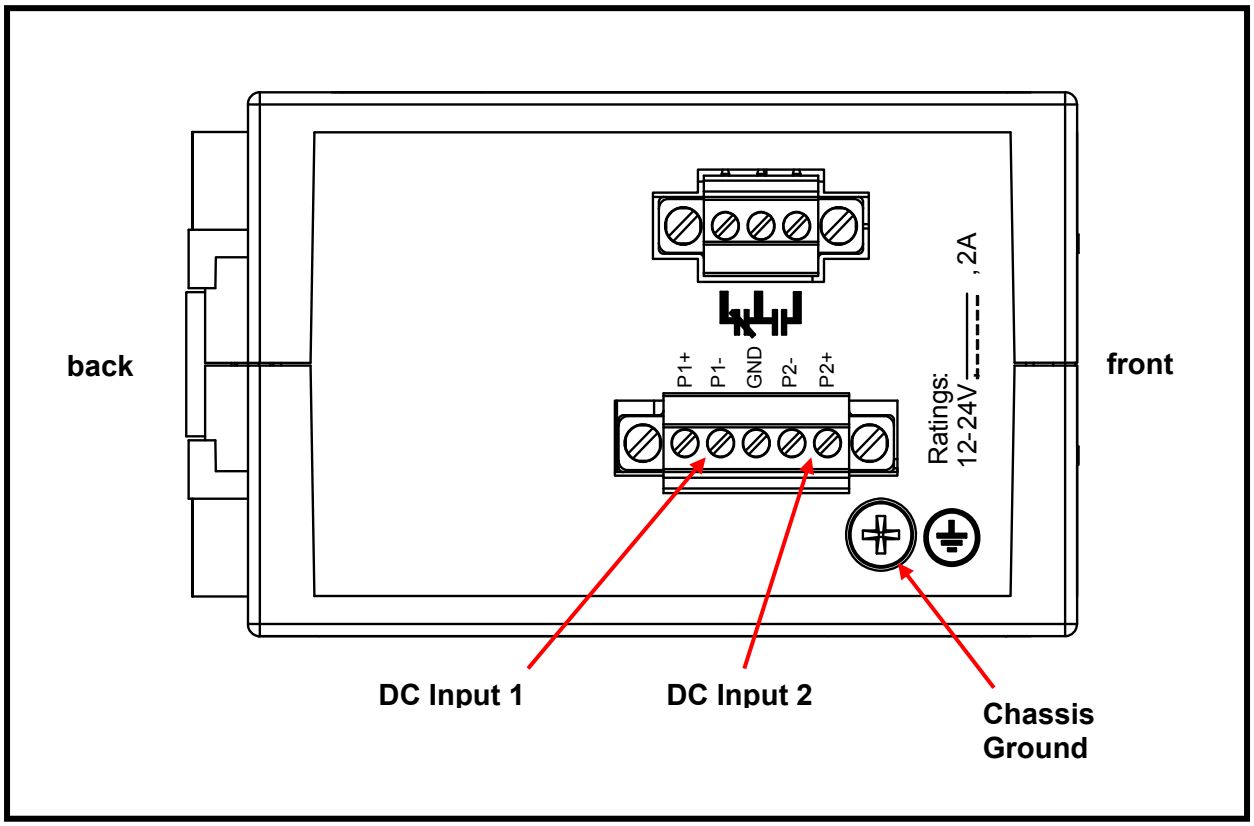

Figure 5: DC Power supply and ground connections

The low voltage DC power supply features reverse polarity protection and dual independent inputs, allowing the connection of two DC sources with the same nominal voltage to provide redundant power supplies. A list of power and ground connections follows in Table 3.

Pin	*Function*	*Connector*
P1+	DC Power Supply 1 positive terminal	Phoenix connector
P1-	DC Power Supply 1 negative terminal	Phoenix connector
GND	Power Supply Ground	Phoenix connector
P2-	DC Power Supply 2 negative terminal	Phoenix connector
P2+	DC Power Supply 2 positive terminal	Phoenix connector
Chassis Ground	Chassis Ground connection	Screw terminal on chassis

Table 3: Power Supply Connector Pinout

NOTE: Terminals P1-, P2-, and GND are connected together internally.

Figure 6 illustrates the connections required for both single and dual power supply configurations:

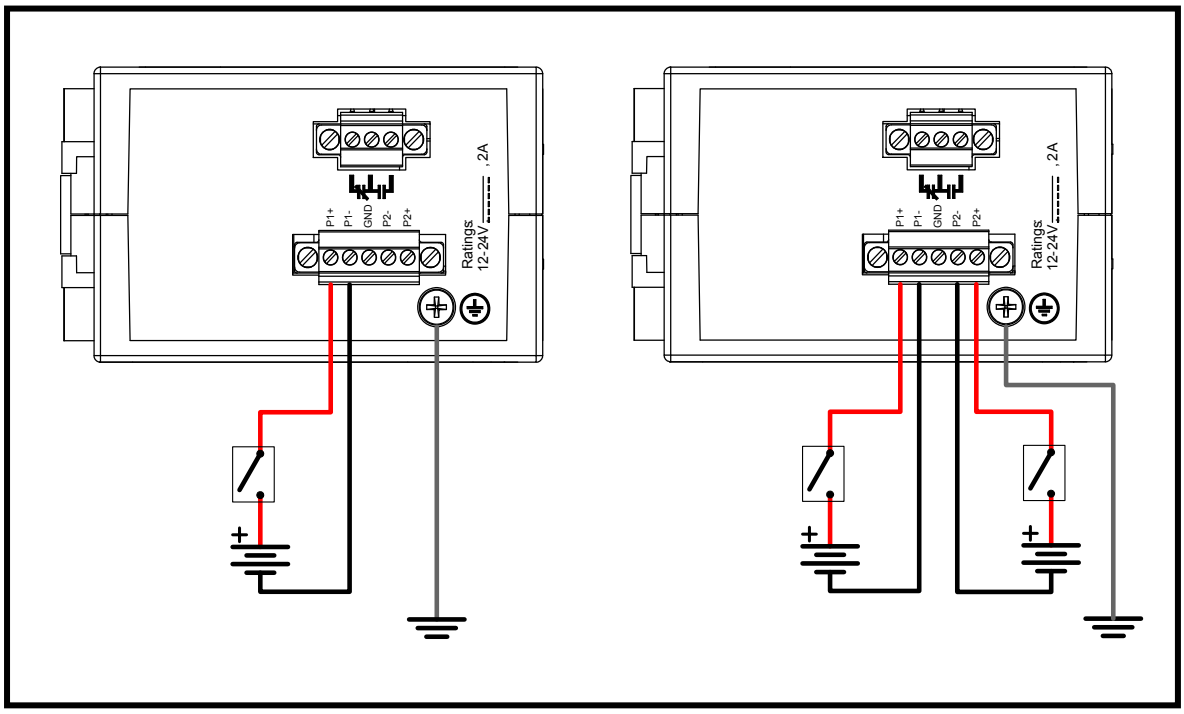

Figure 6: Power Supply Wiring Examples

NOTES:

- Connect to the DC inputs according to the polarity markings on the unit.
- Chassis Ground must be connected to the protective earth.
- The internal connection between P1-. P2-, and GND means that if two power supplies are connected to the unit, their negative terminals must be at the same potential.
- Equipment must be installed according to the applicable country wiring codes.

2.3 Failsafe Output Wiring

The Failsafe output relay is provided via a Phoenix connector to signal critical error conditions that may occur on the unit. The contacts are energized upon power up of the unit and remain energized until a critical alarm condition or power loss occurs. A common application for this output is to signal an alarm in the event of power failure.

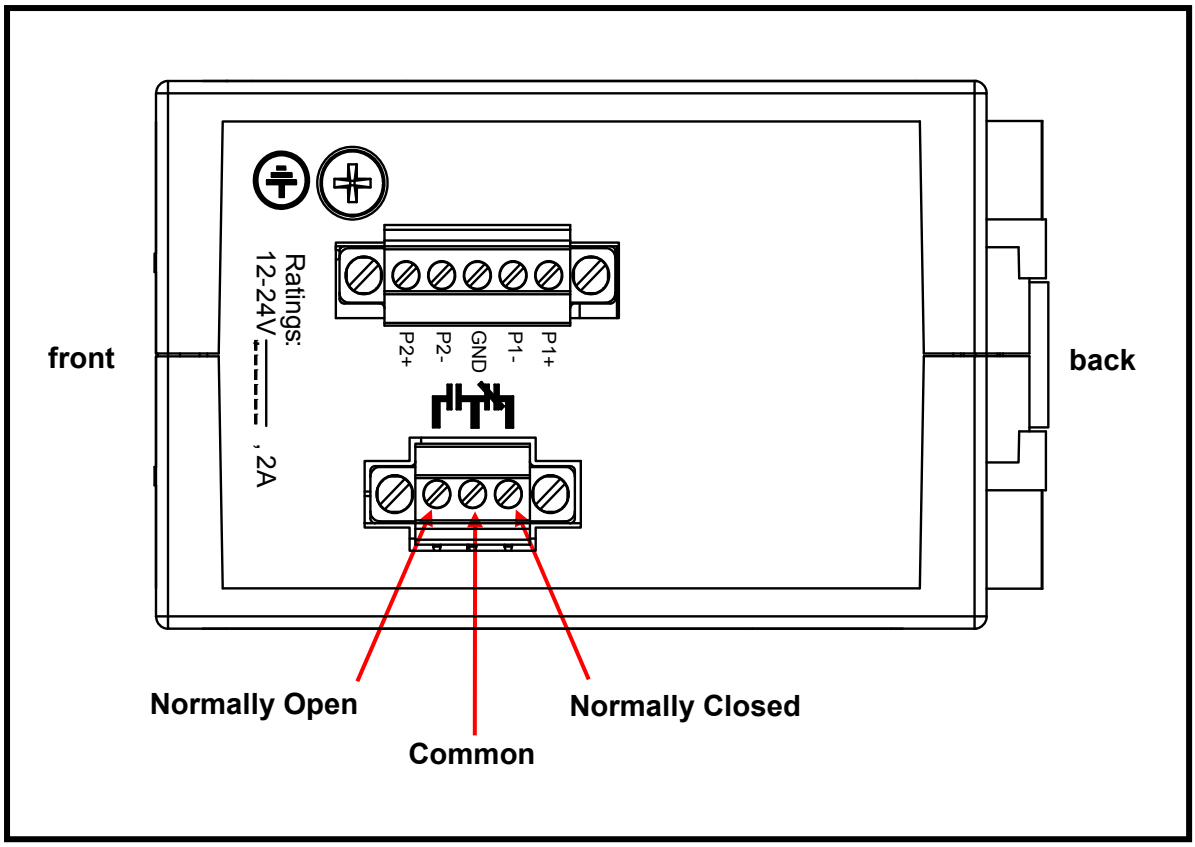

Figure 7: Failsafe Output Relay

Pin	*Function*
Normally Closed	Normally closed (no power or critical alarm condition)
Common	Common relay contact
Normally Open	Normally open (no power or critical alarm condition)

Table 4: Failsafe Output Relay Pinout

2.4 RS232 Console Port Wiring

The RS232 Console Port is used for initially configuring the unit. The connection is made using a DB9-Female to RJ45 console cable with the pin-outs listed in Table 5.

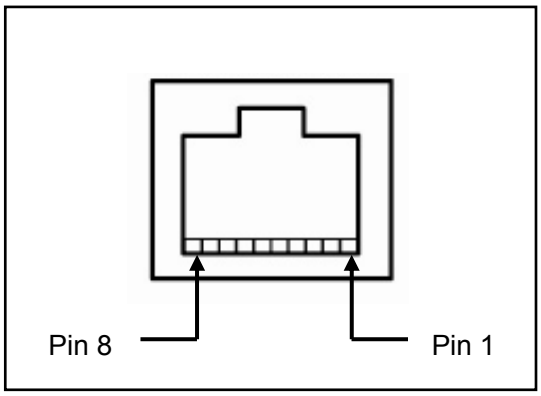

Figure 8: RS232 Female DCE pin-out

RuggedCom RS232 over RJ45 pin-out specification		
Signal Name (PC is DTE)	*DB9- Female*	*RJ45 Male*
DCD – Carrier detect	1	2
RxD – Receive data (to DTE)	2	5
TxD – Transmit data (from DTE)	3	6
DTR – Data terminal ready	4	3
Signal GND	5	4
DSR – Data set ready	6	1*
RTS – Ready to send	7	8
CTS – Clear to send	8	7
RI – Ring Indicator	9	1*

Table 5: RS232 over RJ45 console cable pin-out

NOTE:

- This port is not intended to be a permanent connection
- The cable must be less than 2m (6.5 ft) in length.
- The following cross-connections are made inside the *i*800:
  - DSR / RI / DTR
  - RTS / CTS
- DCD is **not** connected.

2.5 RJ45 Ports – Signal Description

10/100Base-TX ports allow connection to standard Category 5 (CAT-5) unshielded twisted-pair (UTP) cable with RJ45 male connectors. The RJ45 receptacles are directly connected to the chassis ground on the unit and can accept CAT-5 shielded twisted-pair (STP) cables. If shielded cables are used, care must be taken to ensure that a ground loop is not formed via the shield wire and the RJ45 receptacles at either end. Figure 9 shows the RJ45 port pin-out.

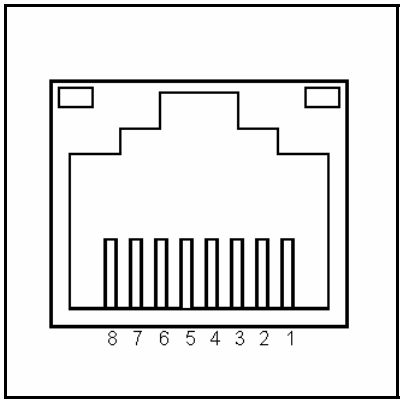

Figure 9: RJ45 Ethernet port pin-out

Pin	*Signal*
1	+Rx
2	-Rx
3	+Tx
4	Terminated
5	Terminated
6	-Tx
7	Terminated
8	Terminated
Case	Shield (Chassis Ground)

Table 6: RJ45 Ethernet port pin-out

NOTE:

The unused pins, 4, 5, 7, and 8 are terminated to Chassis Ground via a network that improves EMI and ESD performance.

RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients. This means that during a transient event, communications errors or interruptions may occur but recovery is automatic.

RuggedCom also does not recommend using these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

2.6 Memory Slot

The *i*800 family of switches feature a removable microSD memory module to support the following features:

- Configuration update and backup
- Redundant firmware image
- Greatly expanded logging capability
- Fault-tolerant firmware update

In case of unit failure, remove power from the unit and unplug any attached network, alarm, and console cabling. Carefully remove the memory card, observing the following precautions:

- Power down the unit before removing the memory card.
- Do not touch the memory card contacts.
- Do not expose the memory card to extremes of temperature or humidity.
- Do not expose the memory card to large magnetic or static electric fields.
- Do not bend or drop the card.

Before applying power to a replacement unit, replace the memory card in the replacement unit with the one taken from the failed unit. Reconnect all necessary cabling and apply power.

WARNING:
The memory card must not be removed or replaced during normal operation. Ensure that power is not applied to the unit when removing or inserting the memory module.

NOTE: These features are pending and are not currently supported. The memory card shipped with the unit will support these features as they become available. Please contact RuggedCom for details.

3 Technical Specifications

3.1 Type Test Specifications

IEC 61000-6-2 EMC: Generic Standards - Immunity for industrial environments			
Test	***Description***		***Levels***
IEC 61000-4-2	ESD	Enclosure Contact	+/- 4kV
		Enclosure Air	+/- 8kV
IEC 61000-4-3	Radiated RFI	Enclosure ports	10 V/m, 80 to 1000Mhz
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 1kV @ 5kHz
		DC Power ports	+/- 1kV @ 5kHz
IEC 61000-4-5	Surge	Signal ports	+/- 1kV line-to-earth/line
		DC Power ports	+/- 0.5kV line-to-line +/- 1kV line-to-earth
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V @ 0, 5-80 MHz
		DC Power ports	
		Earth ground ports	
IEC 61000-4-8	Magnetic Field	Enclosure ports	30 A/m @ 50, 60 Hz
IEC 61000-4-11	Voltage Dips	DC Power ports	30% reduction for 0.5 period
IEC 61000-4-12	Damped Oscillatory	Signal ports	1kV common mode 0.5kV differential mode
		DC Power ports	
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	10V continuous 100V for 1s
		DC Power ports	
IEC 61000-4-17	Ripple on D.C. Power Supply	DC Power ports	10%

Table 7: Electromagnetic Compatibility tests

IEC Environmental Type Tests			
Test	***Description***		***Test Levels***
IEC 60068-2-1	Cold Temperature	Test Ad	-40°C, 16 Hours
IEC 60068-2-2	Dry Heat	Test Bd	+85°C, 16 Hours
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55°C , 6 cycles
IEC 60255-21-1	Vibration	Tests Fc	1g @ (10 - 500) Hz
IEC 60255-21-2	Shock	Tests Ea	30g @ 11mS

Table 8: Environmental Type Tests

3.2 Environmental Specifications

Parameter	*Range*	*Comments*
Ambient Operating Temperature	-20 to 60°C -40 to 85°C (Optional)	Ambient Temperature as measured from a 30 cm radius surrounding the center of the enclosure.
Ambient Storage Temperature	-40 to 85°C	
Ambient Relative Humidity	up to 95%	Non-condensing, 55°C, 6 cycles
Vibration	1g	(10-500Hz)
Shock	30g	11ms

Table 9: Environmental Specifications

3.3 Power Supply Specifications

Power Supply Type	*Minimum Input*	*Maximum Input*	*Fuse Rating*	*Maximum Power Consumption*
24 VDC	9 VDC	36 VDC	3A (T)	9W

Table 10: Power Supply Specifications

NOTES:

- (T) denotes a time-delay fuse
- For continued protection against risk of fire, replace only with same type and rating of fuse.

3.4 Failsafe Relay Specifications

Parameter	*Value*
Max Switching Voltage	30VAC, 80VDC
Rated Switching Current	0.3A @ 30VAC 1A @ 30VDC, 0.3A @ 80VDC

Table 11: Failsafe Relay Specification

NOTES:

- Resistive Load.
- For Class-2 circuits only.

Isolation	*Comments*
1500 V_{rms}	Dielectric test voltage (1 minute) between coil & contacts

Table 12: Failsafe Relay Isolation

3.5 RJ45 Ethernet Port Specifications

Data Port	*Media*	*Distance*	*Connector Type*
10/100 Mbps	CAT-5 UTP or STP	100m	RJ45

Table 13: RJ45 Ethernet Port Specifications

3.6 Fiber Optic Port Specifications

Order Code	Speed Standard	Mode / Connector	Tx (nm)	Cable Type (um)
_FG01	1000SX	MM/LC	850	62.5/125
_FG03	1000LX	SM/LC	1310	9/125
_FX11	100FX	MM/LC	1310	62.5/125
_FX06	100FX	SM/LC	1300	9/125

Table 14: Fiber Optic Port Specifications

Order Code	Tx min (dBm)	Tx max (dBm)	Rx Sensitivity (dBm)	Rx Saturation (dBm)	Typical Distance (km)	Power Budget (dB)
_FG01	-9.5	-4.0	-20	0.0	0.4	10.5
_FG03	-9.5	-3.0	-21	-3.0	10	11.5
_FX11	-19	-14	-32	-14	2	13
_FX06	-15	-8.0	-38	-3.0	20	23

Table 15: Fiber Optic Port Specifications (continued)

NOTES:

- All values listed are average values
- To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.
- Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.

3.7 Physical Dimensions

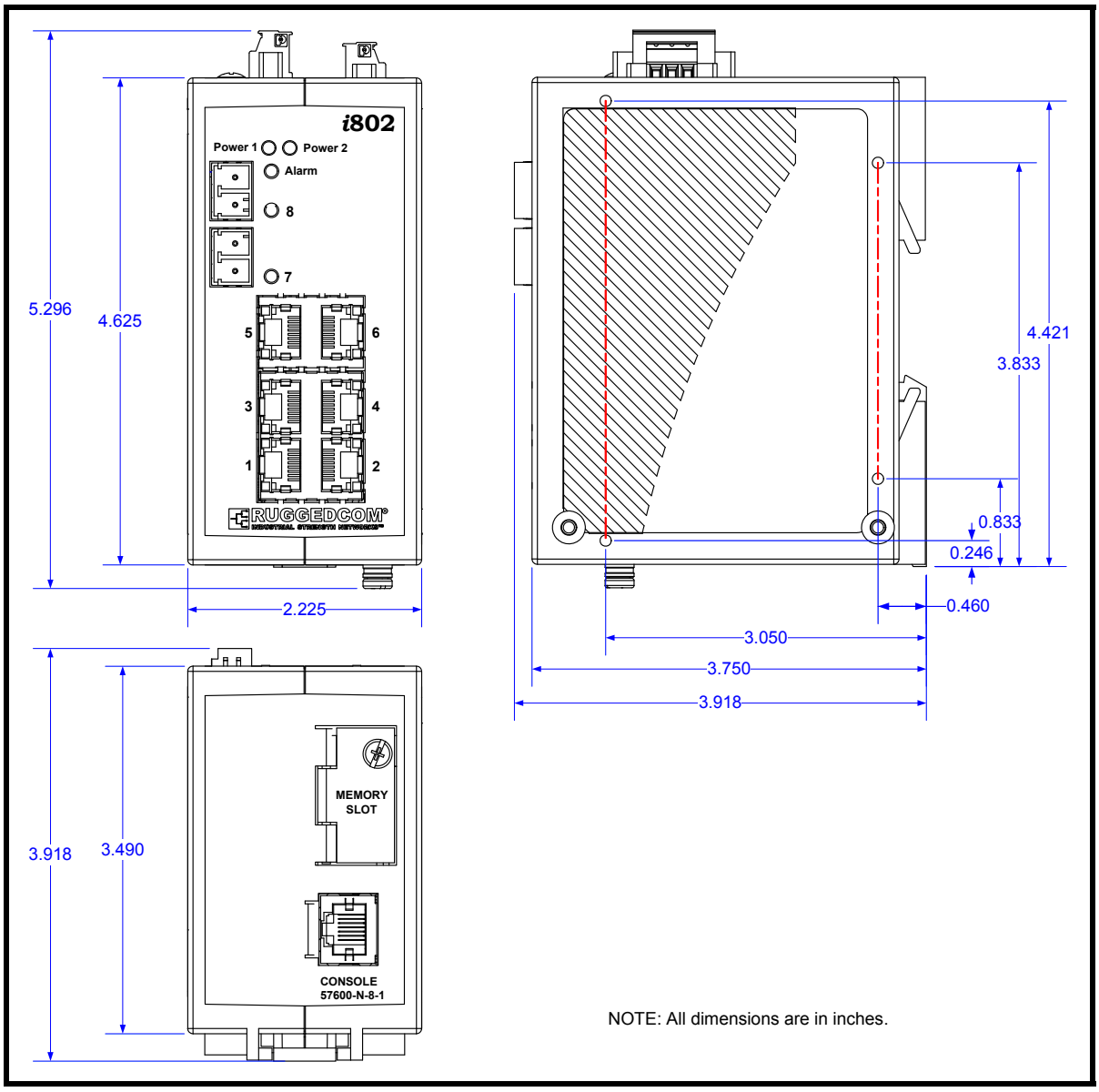

Figure 10: Mechanical Specifications

Parameter	*Value*	*Comments*
Dimensions	4.625 x 2.25 x 3.75 inches (117 x 57 x 95 mm)	(height x width x depth)
Weight	1.5 lb (0.68 Kg)	
Enclosure	Die cast Aluminum	

Table 16: Physical Dimensions

3.8 Agency Approvals

Agency	Standards	Comments	Status
ATEX	Zone 2	Gas, Vapor, or Dust environmental	Pending
FCC	FCC Part 15, Class A	Emissions	Approved
EN/CISPR	EN55022 (CISPR22), Class A	Emissions	Approved
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Laser Eye Safety	Pending
ISO	ISO9001:2000	Design and manufacturing process	Certified quality program
cUL	cUL1604 (Class 1, Division 2)	Hazardous Location	Pending
cUL	cUL508 (UL508/CDA C22, EN61010-1)	Safety	Pending

Table 17: Agency Approvals

4 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit http://www.ruggedcom.com or contact your customer service representative. Should this product require warranty or service contact the factory at:

RuggedCom Inc.
30 Whitmore Road,
Woodbridge, Ontario
Canada L4L 7Z4

Phone: (905) 856-5288
Fax: (905) 856-1995

Warranty Exclusion: The *i*800 ("*i*-Series") product line is not intended for nor shall they be used for or as part of any activity or process involving electric utility substation applications. Should these products be used for electric utility substation applications, the following applies: (i) product performance is not guaranteed; (ii) the manufacturers warranty will not be applicable (i.e. it will be voided and technical support will not be provided) and (iii) RuggedCom will not accept any liabilities as a result of performance issues.